

ORIGINAL ARTICLE

Determinants of Healthcare Workers' Willingness to Receive COVID-19 Vaccination

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ABSTRACT

Introduction: The expedited COVID-19 vaccine has challenged people's belief and perception of its effectiveness. The purpose of this study was to identify whether knowledge related to Covid-19 and perception of effectiveness of Covid-19 vaccine would predict health-care workers' willingness to take the vaccine. **Methods:** A cross-sectional design using a convenience sampling technique was used to collect data from 302 HCWs. HCWs targeted included all those working at healthcare settings in Jordan. Data collected regarding knowledge related Covid-19 and perception of effectiveness of Covid-19 vaccine. Data collected using a self-administered questionnaire. **Results:** HCWs have moderate to high level of knowledge related to vaccines of Covid-19 and its effectiveness. High level of willingness to take the vaccine was also observed among HCWs. Those with higher level of knowledge and positive perception of effectiveness of Covid-19 vaccine are more likely to take the vaccine ($p < .05$); however, not highly influential ($R^2 = 27\%$). Demographic characteristics have not been found to influence HCWs' decision to take the vaccine. **Conclusion:** There is a need to enhance positive perception of effectiveness of Covid-19 vaccine among health professionals through appropriate education and procedures.

Keywords: COVID-19 vaccines, Effectiveness of Covid-19 vaccines, Willingness to receive vaccine, Healthcare workers

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10 million deaths between 2010-2015 worldwide (4). Therefore, public health authorities have called for speeding out the vaccination campaigns as one significant measure for Covid-19 control.

INTRODUCTION

Coronavirus disease 2019 (Covid-19) resulted in significant negative impact on global health and social and economic systems. The scientific bodies of health systems around the world were accelerated to discover treatment and test effectiveness of vaccines that prevent and control the disease. It has been recommended that the effective measures to control the disease is to adhere to preventive and public safety measures (1). The vaccination; however, proposed as the most successful mean to control spread of virus and protect humans from the disease (2). Therefore, developing effective and safe vaccines will be the most promising approach to be adopted to control the virus, save lives, and contain the public health crisis (3). The World Health Organization (WHO) estimated that vaccines prevented at least

Accepting and supporting vaccination is still debated and confusing issue. This has been raised by the WHO where they asserted that people may refuse taking the vaccines and jeopardizing the global health. However, with the substantial efforts on vaccine development underway, it becomes necessary to examine individuals' acceptance to receive the Covid-19 vaccine (5). According to Guidry and colleagues (1), the expedited development of vaccine could be a major challenge to the public impressions and acceptance for vaccination. The available limited studies indicated that accepting vaccination is influenced by HCWs' personal characteristics such as gender and age, information available about the safety and effectiveness of the vaccine(6). Whilst, health-care workers (HCW) are assumed to be more knowledgeable and positively oriented toward the acceptance and effectiveness of the vaccine, the studies have not explored such an issue.

For the Covid-19 vaccine to be successful, people and healthcare professionals need to accept and adopt positive attitudes and behaviors toward the vaccination (6). This required an understanding of individuals' perception of the effectiveness of the vaccine and the public health procedures posed by local authorities to correct misconceptions and encourage vaccination (2). Hence, perspectives toward the vaccine is dependent upon disseminating valid and reliable information about the vaccine and its effectiveness (7). Health-care workers are, as aforementioned, trained and well informed either personally through their formal education, self-learning or/and the in-services education departments about the importance of vaccination. Nevertheless, the confusing information and expedited development of vaccines around the world may influence HCW's attitudes and acceptance of vaccination. Therefore, it is vital for policymakers and authorities to understand and enhance positive understanding of Covid-19 vaccination and to enable successful vaccine protocols. Among the most influential people are the HCWs. It is assumed that this group, the HCWs, are seen as leaders and trustful resource of information that contribute to a positive atmosphere and send positive messages about the vaccine (6). Therefore, it is important that HCWs adopt positive perception of effectiveness of the vaccine and should have positive intention and willingness to receive the vaccine. This would improve the general population perception of effectiveness of the vaccine and enhance their positive behaviors towards receiving the vaccine. Several factors reported that could affect the HCW's attitudes toward Covid-19 vaccination and their intention to take the vaccine including age, gender, history of chronic disease, history of Covid-19 disease and its severity, knowledge and perceived benefits of vaccination, and Covid-19 vaccine safety/cost concerns (8).

Pertaining to Jordan, the vaccination campaign started by the middle of January 2021, and according to the Jordanian Ministry of Health, the total number of people who received the two doses of vaccine till October 2021 3.3 million representing 32.3% of the total population (9). Those who registered are considered less than 10% of the total population; therefore, the public health authorities launched a campaign to increase registration and acceptance of vaccination. The government has announced a package of incentives for public and private sectors that are related to vaccine acceptance. For example, opening hours, free traveling during curfew hours if vaccinated, attending public and private events if vaccinated. On the other hand, some other negative reinforcement done such as not allowing facilities to increase their human power capacity if not vaccinated and forcing individuals for weekly PCR test if not vaccinated (9). While public health awareness is important and being emphasized in the literature, HCW's perception and acceptance have not. Thus, the purpose of this study was to identify whether knowledge related

Covid-19 and perception of effectiveness of Covid-19 vaccine would predict health-care workers willingness to be vaccinated against Covid-19. The specific aims are: To identify health-care workers' knowledge related to Covid-19 and their perception of effectiveness of Covid-19 vaccinations, and to examine the prediction power of knowledge related to Covid-19 and perception of effectiveness of Covid-19 vaccinations on willingness to be vaccinated against Covid-19 among health-care workers controlling for sociodemographic and health related factors.

MATERIALS AND METHODS

Design

A cross-sectional design has been used to answer the research question. Data were collected from HCWs using an online self-administered questionnaire in relation to HCW's knowledge and perception of effectiveness of Covid-19 vaccines and their willingness to be vaccinated against Covid-19.

Sampling and Settings

Data collected from all health care settings in Jordan targeting HCW, including all health sectors in Jordan (university-affiliated, public, private and military). A convenient sampling technique was used to recruit 302 HCWs; 500 surveys sent out and 302 returned filled (60.4% response rate). Sample size was estimated using G. power 3.0.10 (10). Using small effect size of 0.15, at power of 0.80 at 0.05 two-tailed level of significant using standardized generic Z test, the required sample size was at least (278) health-care professional.

Inclusion criteria included all HCWs (doctors, nurses, pharmacists, midwives, and laboratory technicians, etc.) whether working directly with patients confirmed with Covid-19 or not. There were no exclusion criteria to maximize participation.

Data collection

Ethical approval obtained from IRB of the University of Jordan, School of Nursing prior to data collection (P.F.21.10-14-1-2021). The research used the network approach to recruit the sample of the study. The research used social media and networking to announce the study and its purpose and significance. The social media included professional groups, networks, and organizations' email list if available. The announcement included information related to title, purpose, significance, targeted population, confidentiality, privacy of information, and that the study is anonymous and voluntary. Those interested in participating were asked to contact the research team. Once the research team contacted, all participants have been answered for all inquiries and questions prior to signing an electronic consent form. The survey was a two-phase online, in which those expressed interest to participate asked to sign consent form that will take them directly to the

survey. The front page was the consent form, where the participant needs to sign electronically to move into the survey package. Ethical considerations were addressed for all HCWs before, during, and after data collection. The survey took 10 minutes to be filled out. All data were kept in a password-protected computer file.

Measurement

Data collected using an online format of Arabic self-administered questionnaire. WHO guideline for translation and tool adaptation used to translate the scales that are not available in Arabic. The tools have been checked for validity using the face and content validity approaches through a panel of expert. the WHO guidelines were used and followed to reach the final draft of the translated versions of the tools. The tools were:

Knowledge related to Covid-19 measured using the Arabic version of the scale (11). The scale is formed of 23 items. The scale is formed of four parts; general knowledge about the disease, (3 items), signs and symptoms of Covid-19 infection (7 items), risk factors for Covid-19 (7 items) and means of transmission of Covid-19 (6 items). HCWs are required to make their responses on a 3-point Likert scale (3= Yes, 2 = No, 1= do not know). The scale, for the purpose of the study, collapsed then into yes (1) versus no and do not know (0) where the higher the score indicating the higher the level of knowledge. The interquartile range used to identify level of knowledge. The psychometric properties showed good internal consistency with Cronbach's alpha of .74(ranging from .84 signs and symptoms to .71 for means of transmission).

Perception of effectiveness of Covid-19 vaccine was measured using an adapted scale utilizing information compiled from national and international guidelines and equivalent studies addressing Covid-19 vaccines (12-14). The scale is formed of 15 items with a 3-point Likert scale (3= agree, 2=neutral, 1= disagree). The higher the score indicates more positive perception of effectiveness of Covid-19 vaccines a, while lower score infers tendency towards lower perception of effectiveness. The internal consistency showed that the scale has good reliability with Cronbach's alpha of .71.

Willingness to receive Covid-19 vaccine was measured utilizing information compiled from national and international guidelines and equivalent studies addressing Covid-19 vaccines (12-14). The scale is formed of 7 items with a 3-point Likert scale (3 = agree, 2 = neutral, 1= disagree). The higher the score indicates more positive intention and willingness to take the Covid-19 vaccines. The internal consistency showed that the scale has good reliability with Cronbach's alpha of .83.

In addition, a demographic data including age, gender,

marital status, profession, years of experience, history of chronic diseases, severity of Covid-19 infection if infected, the source of information regarding Covid-19 was also used .

Pilot testing

A pilot study conducted prior to data collection using a random sample of health care providers from the target population, which forms 10% of the actual study sample size. Their appraisals requested for the appropriateness of the translation, checking for understandability, and clarity and time required for filling the questionnaires. Another objective of this pilot study is to assess whether the proposed data collection procedure is realistic, feasible and workable. The participants asked for feedback to identify difficult questions and time had taken to complete the questionnaire. Pilot study procedure was done in the similar way as it administered in the main study. Minor linguistic changes done according to subjects' responses. Data from the pilot study were not included in the final study analysis.

Data analysis plan

Data were analyzed using the statistical package for social sciences (IBM-SPSS 24). Knowledge, perception of effectiveness of the vaccine, willingness to take the vaccine, and sociodemographic variables were described using the central tendency measures and dispersion measures. t-test, ANOVA when appropriate, Pearson r were used to test association, differences and compare groups of the participants. Quartile equation has been used to decide about the levels per variables of the study. Data screening and cleaning were done. Assessment of the assumption for the main variables of the study was done; knowledge related to Covid-19 and their perception of effectiveness of Covid-19 vaccinations. This variable demonstrated acceptable levels of skewedness indicating that all variables were normally distributed (skewness= -1 to +1) (15). Level of significance was set at alpha 0.05.

RESULTS

Descriptive characteristics

A total of 302 HCWs filled out the survey. Age ranged from 20 to 72 years old, with a mean of 35.0 years (SD = 9.5). This group included more females (56.6%, n = 171) than males (43.4%, n = 131). Regarding job title, place of work and experience; the majority of HCWs were nurses (64.9%, n = 196), working in governmental hospitals (56.3%, n = 170) and the total number of years of experience ranged from 0.08 to 21.3 years, with mean of 10.3 (SD = 7.1) years (Table I).

Health-related factors

In this study, 14.9% (n=45) have chronic illnesses. In total, 32.5% (n=98) have reported being infected with Covid-19. Among those who had been reported, 30.6% (n=30) have suffered mild symptoms, 40.8% (n=40)

Table I: Demographic characteristics

Variable		n	%
Gender	Male	131	43.4
	Female	171	56.6
Marital status	Single	87	28.8
	Married	204	67.5
	Divorced	7	2.3
	Widow	4	1.3
Job title	Nurse	196	64.9
	Physician	25	8.3
	Attending physician	24	7.9
	Pharmacist	16	5.3
	Others	41	13.6
	Place of work	University affiliated	36
Governmental		170	56.3
Private		80	26.5
Military		16	5.3
Chronic illnesses	Yes	45	14.9
	No	257	85.1
Covid-19 infection	Yes	98	32.5
	No	204	67.5
Death of family member due to Covid-19	Yes	42	13.9
	No	260	86.1

have suffered moderate, and 25.5% (n=25) have suffered severe symptoms. Only 3% (n=3) had been admitted to hospital with 1% to general wards and 2% to ICU.

Knowledge about Covid-19

Regarding HCW’s knowledge of Covid-19, the analysis showed (table II) that scores ranged from 0 to 22 with mean of 19.7 (SD = 2.9). 50% of HCWs scored 18 or above. Considering that the expected scores ranging from 0 to 23, the analysis indicates that HCWs have high level of knowledge.

Regarding items analysis (table III), HCWs’ responses (yes answers) ranged from 57% (Covid-19 had no effective treatments and vaccine currently), to 96.4% (is body pain a symptom of Covid-19). The analysis also showed that HCWs lack appropriate knowledge about availability of effective treatment and vaccine (57.0%), lack the knowledge that: sore throat could be a sign of Covid-19 (75.2%), Covid-19 is more dangerous in HTN (hypertension) patients (74.2%), and that the virus is transmitted directly through direct talking (non-masked) with infected individuals (66.6%).

Perception of effectiveness of Covid-19 vaccine

Table II: Description of variables of the study

Variable	M	Md	SD	Min	Max
Knowledge total score	17.9	18.0	2.9	0	22
Knowledge about the disease	2.1	2.0	0.8	0	3
Knowledge about the signs and symptoms	5.4	6.0	1.1	0	7
Knowledge about the risk factors	5.4	6.0	1.2	0	6
Knowledge about the protective measures	5.0	5.0	1.4	0	6
Perception of Effectiveness	33.4	33.0	4.3	17	45
Willingness to receive vaccine	13.6	13.0	2.7	7	21

Table III: HCWs’ Knowledge related to Covid-19 disease, signs and symptoms, risk factors, and protective measures (N = 302)

Variables	Yes	
	N	%
<i>General information about the disease</i>		
Covid-19 is most contagious disease	204	67.5
the incubation period of the diseases is 2 days to 14 days	263	87.1
Covid-19 had no effective treatments and vaccine currently	172	57.0
<i>Signs and symptoms of COVID-19 infection</i>		
Is fever a symptom of Covid-19	277	91.7
Is cough a symptom of Covid-19	276	91.4
Is sore throat a symptom of Covid-19	227	75.2
Is body pain a symptom of Covid-19	291	96.4
Is headache a symptom of Covid-19	287	95.0
Is diarrhea a symptom of Covid-19	249	82.5
Is constipation a symptom of Covid-19	278	92.1
<i>Risk factors</i>		
Covid-19 is more dangerous with people age >50 years old	225	84.4
Covid-19 is more dangerous in HTN patients	224	74.2
Covid-19 is more dangerous in DM patients	256	84.8
Covid-19 is more dangerous in elderly above age 65	285	94.4
Covid-19 is more dangerous in patients with cancer	282	93.4
Covid-19 is more dangerous in patients with immune deficiency diseases	294	97.4
Covid-19 is more dangerous in patients with respiratory problems	296	98.0
<i>Protective measures</i>		
The disease is transmitted directly through cough	271	89.7
The disease is transmitted directly through sneezing	289	95.7
The disease is transmitted directly through direct talking (non-masked) with infected individuals	201	66.6
The disease is transmitted directly through contacts with an infected surface	250	82.8
The disease is transmitted directly through hugging	225	74.5
The disease is transmitted directly through kissing	272	90.1

Regarding HCWs’ perception of effectiveness of Covid-19 vaccine, the analysis (table IV) showed that the mean score was 33.4 (SD= 4.3) with scores ranging from 17 to 45. Moreover, 50% of HCWs scored 33.0 or above. With expected score ranging from 15 to 45, the results indicate that HCWs have moderate to high level of perception of effectiveness of Covid-19 vaccine. It has also been noted that only 25% (percentile 25) of HCWs scored 30 or less, which supports the moderate to high level. Regarding HCWs’ responses (agree responses), the analysis showed that 71.2% (n=215) believe that vaccines are important to community’s health whereas 7.3% (n=22) don’t believe that vaccines are important. In addition, 8.6% (n=26) agree that Covid-19 vaccines are sufficient for preventing Covid-19 while 52.6% (n=159) disagree with it.

Willingness to receive Covid-19 vaccine

Table IV: HCW's perception of effectiveness of Covid-19 vaccine and willingness to receive vaccine (N = 302)

Items	Agree	
	n	%
<i>Perception of effectiveness of Covid-19 vaccine</i>		
1. Vaccines are important for my health.	182	60.3
2. Getting vaccines is a good way to protect myself from disease.	191	63.2
3. Overall, vaccines are safe.	155	51.3
4. Overall, vaccines are effective	164	54.3
5. Getting vaccinated is important for the health of others in my community.	215	71.2
6. There is no need for vaccination as the virus provide a natural immunity.	108	35.8
7. Flu vaccination is sufficient for preventing Covid-19	26	8.6
8. The information I receive about vaccines from public health authorities is reliable and trustworthy.	115	38.1
9. I am concerned about serious adverse effects of vaccines.	173	57.3
10. Covid-19 vaccines made in Europe or America are safer than those made in other world countries.	66	21.9
11. I prefer preventive measures for getting vaccinated.	167	55.3
12. I would advise patients to take the vaccine	129	42.7
13. In general, I do not take annual vaccinations, such as the seasonal flu vaccine	161	53.3
14. The vaccine is part of a conspiracy against humanity	33	10.9
15. What is rumored about the vaccine worries me about its effectiveness	130	43
<i>Willingness to receive the vaccine</i>		
1. I will Accept Covid-19 vaccine because is it available	113	37.4
2. will accept the vaccine for my family	126	41.7
3. I will not accept the Covid-19 vaccine unless recommended by my employer.	42	13.9
4. I'll pay to get the vaccine.	64	21.2
5. Fear of the side effects of the vaccine prevents me from accepting the Covid-19 vaccine.	146	48.3
6. I will refuse to be vaccinated, whatever the reason	81	26.8
7. Scientific research has increased my confidence in taking the vaccine	123	40.7

Regarding health-care workers' willingness to receive Covid-19 vaccine, the analysis (table II) showed that scores ranged from 7 to 21 with mean score of 13.6 (SD = 2.7). with expected range of score from 7 to 21 and 50% of scores are 13 or above, the analysis indicates that HCWs have low level of willingness to take the vaccine. Despite the fact that only 25% (percentile 25) of participants had a score of 11 or less, the scores do not reflect that HCWs do have positive intention and willingness to receive the vaccine. Their responses (agree responses) ranged from 13.9% (n=42) to 40.7% (n=123) indicating low to moderate level of acceptance to take Covid-19 vaccine.

Relationship between knowledge and attitudes, willingness, perception towards effectiveness of COVID-19 vaccination

The analysis, using Pearson r, regarding the relationship between HCW's knowledge and perception of effectiveness of Covid-19 vaccines, their willingness to receive the vaccines showed that there were significant positive correlations ($r = .258, p < .001$; $r = .195, p < .01$, $r = .518, p < .001$; respectively). This indicates that HCWs with high level of knowledge and higher perception of effectiveness of Covid-19 vaccines are more likely to have a higher level of willingness to be vaccinated against Covid-19.

Differences in related to demographics and health-related factors

This study analysis regarding differences in HCWs' knowledge, perception of effectiveness of Covid-19 vaccines, and their willingness to receive the vaccines, using independent t test, showed a significant difference between HCWs' willingness related to gender Covid-19 ($t = 3.21, P = 0.001$). Male HCWs have a high mean score of willingness to receive the vaccine ($M = 14.2, SD = 2.7$) than female ones ($M = 13.2, SD = 2.6$). Also, there was a significant difference between HCWs whom infected with Covid-19 and those who were not in their knowledge ($t = 2.99, p < 0.01$); HCWs infected with COVID-19 have a higher mean score of knowledge ($M = 18.2, SD = 2.3$) than those who were not ($M = 17.8, SD = 3.1$). In addition, differences found in willingness to take vaccine between those who were infected and those who were not ($t = - 2.63, p = .009$). Higher mean score of willingness to receive the vaccine found among those who were infected with Covid-19 ($M = 13.9, SD = 2.5$) than those who were not ($M = 13.0, SD = 2.9$). Regarding association with age, the analysis showed that age has no significant correlation with knowledge, perception of effectiveness of Covid-19 vaccines, and willingness to receive the vaccines. While, years of experience was positively associated with only level of knowledge ($r = .13, p = .026$).

Using one-way ANOVA to examine differences in the main variables related to marital status, job title, place of work, severity of infection, sources of knowledge, death of family member due to Covid-19. The result showed no significant difference ($p > .05$).

Predicting willingness to receive Covid-19 vaccine

To examine whether knowledge, perception of effectiveness of Covid-19 vaccine are significant predictors of willingness to receive vaccine controlling for the selected demographic characteristics and health-related factors (age, gender, job title, place of work, history of Covid-19 infection, death of family members due to Covid-19, years of experience, history of chronic diseases), two- steps multiple hierarchical regression analysis was performed (table V). Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. The Two-steps multiple hierarchal regression analysis was used to identify the optimal set of predictors for the willingness to receive vaccine. Demographic variables and health-related factors entered first into the model 1, and predictors (knowledge, perception of effectiveness of Covid-19 vaccine) entered in model 2. The results showed that model 1 was not significant ($F = 1.21, p = .299$). The model explained 12.2% ($R^2 = .122$) of variation in willingness to receive vaccine. In this model, only gender was a significant negative predictor ($Beta = -.227, p = .04$). In model 2, after adding predictors, the model was significant ($F = 4.69, p = < .001$) and the model explaining 39.8% ($R^2 =$

.398) variations in willingness to receive the vaccine. In this model, only perception of effectiveness of Covid-19 vaccine was a significant predictor ($Beta = .542, p < .001$). The analysis infers that those with higher levels of perception of effectiveness of Covid-19 vaccine are more likely to have higher level of willingness to receive the vaccine. Knowledge; however, was found not to be significant predictor nor the demographic and the health-related factors.

DISCUSSION

The expedited development of vaccines have contributed to doubtful feeling and challenge to public health authorities to market and disseminate appropriate knowledge about the vaccines and its effectiveness (2). The study aimed at exploring whether HCWs' knowledge would predict their willingness to take the Covid-19 vaccine. Health care workers are assumed to be knowledgeable and adopt positive attitudes and perception towards receiving the vaccination. However, less is known about their actual perception of effectiveness of Covid-19 vaccination and their willingness to receive the vaccine. This concern has been addressed in this study. We found that HCWs have moderate to high level of knowledge about Covid-19, moderate level of perception of effectiveness of Covid-19 vaccines and low to moderate level of willingness to receive the vaccine. More important outcomes, we have found that perception of effectiveness of Covid-19 vaccines is positively associated and predicting willingness to receive vaccines controlling for demographic and health-related factors.

The study indicates that HCW, as expected, have the appropriate knowledge about Covid-19 disease, signs and symptoms, risk factors and protective measures. However, HCW still lack of appropriate knowledge in particular topics such as the believe that Covid-19 has a treatment, that sore throat is one signs of the disease, that those diagnosed with hypertension are at risk to Covid-19 and that the disease is transmitted directly through direct talking (non-masked) with infected individuals. In particular, HCWs do have knowledge about Covid-19; however, being expert and professional in the field of health, we have assumed that they should possess a very high level of knowledge due to the fact that they have been intensively trained on Covid-19 and related information which was not. This could be related to widespread knowledge about the most significant signs and symptoms of the disease and to the huge confusing flow of information about the types of vaccines and their effectiveness (1). Although extensive training programs and campaigns have been endorsed to healthcare workers, differences remain expected due to variations in resources used and personal preferences of type of information and level of confidence in these resources. The findings of this study do support most recent studies related to the topic (16-17). This would

Table V: Two-steps Multiple Hierarchal Regressing willingness to receive vaccine on knowledge and perception of effectiveness of Covid-19 vaccine controlling for demographic and health related factors among Healthcare workers (N = 302)

Variables	Model 1		Model 2		
	β	P-value	β	P-value	
Age	-.199	.384	-.063	.742	
Gender	-.227	.041	-.126	.181	
Job title	.038	.722	-.041	.650	
Place of work	.126	.250	.073	.437	
Years of experience	.340	.133	.161	.398	
Do you have chronic illness	.105	.345	-.039	.680	
Being infected with Covid-19	-.121		-.069	.457	
Death of family member due to Covid-19	-.067		-.060	.501	
Knowledge			-.069	.435	
Perception of Effectiveness			.056	<.001	
Model	R^2	Adj R^2	R^2 change	F	p
1	.122	.021		1.21	.229
2	.398	.313	.276	4.96	<.001

also should be considered in light of the serious forms of Covid-19 pandemic and its biopsychosocial effect on health of individuals (18-19). We have found previously that mental and psychological and physical wellbeing of Jordanian has been affected at various levels and among different groups (20-21) which may influence positively the perception of HCWs towards the effectiveness and their belief to counteract the panic forms related to spread of Covid-19.

One novel finding in this study was that HCWs' perception of effectiveness of Covid-19 vaccine and willingness to receive the vaccine was moderate to low. Lack of comparative studies around the world might not enable comparing findings and explain low preferences and negative perception. However, among public people, it has been reported that two-thirds of those surveyed for willingness to receive the vaccination were found to be positive although were concerned about the efficacy and side effects of the vaccines (2). On the other hand, factors such as gender, history of chronic disease, history of Covid-19 disease and its severity level if infected did influence the decision of HCWs to receive the vaccine (8, 22-23). In our study, perception of effectiveness of Covid-19 vaccine and willingness to receive vaccine were not associated with any of the demographic or health-related factors. This could be related to the differences between HCWs and public people as HCW constantly receiving trainings, provided with knowledge and able to retrieve appropriate information from valid and reliable resources regarding Covid-19 disease treatment and vaccine development.

The regression analysis in this study also proved that HCWs' perception of effectiveness of Covid-19 vaccine do predict their willingness to receive vaccine controlling for demographic and health-related factors. In other word, HCWs with higher level of perception of effectiveness of Covid-19 are more likely to have higher level of willingness to receive the vaccines. Eventually, this could be expected in normal situations where HCWs did score high in their effectiveness. Interestingly, and although reported higher level of knowledge related to Covid-19, HCWs' knowledge was not statistically significant predictor of willingness to receive Covid-19 vaccine. As aforementioned, we have found that HCWs are appropriately equipped with knowledge related to Covid-19, but certain and specific topics need to be enhanced and corrected. Furthermore, HCWs have low level of perception of effectiveness and willingness to receive the vaccine which may indicate the variation existed among health-care workers although no significant differences found in relation to job title, years of experience or even among those who are infected and those who are not. Years of experience played significant role in knowledge differences, being infected with Covid-19 had significant contribution to willingness and knowledge, and gender differences found in related to willingness to receive the vaccine.

Not being able to detect differences related to perception of effectiveness of Covid-19 vaccines is one significant novel findings here. One explanation could be related to the low scores of perceptions of effectiveness, and another explanation is related to availability of information regarding the vaccines. The study findings correspond with very recent study (23), that healthcare workers do have positive attitudes towards accepting Covid-19 vaccine; however, the level of acceptance is still challenged with more positive reports about the vaccines and its side effects. Such perception could influenced the public perception and acceptance to register and receive the vaccine evident by the small number of people who have registered to receive the vaccines in Jordan.. The perception of effectiveness is expected to be enhanced with more vaccinations and clinical observation of those who received the vaccine. Willingness; therefore, is expected to be increased among HCWs and even among the public with more doses made available and a smaller number of people reporting side effects of the vaccines. The study proves that demographic and health-related factors do not influence the willingness to receive the vaccines which does not agree with previous recent reports that health history and gender are significant correlates to the willingness to be vaccinated (22-23).

One limitation of this study is related to using cross-sectional design in which HCWs responded to the survey using self-report format only. Another limitation is related to using a convenience sample that would affect the generalizability of the findings.

CONCLUSION

The study found that HCWs do have appropriate level of knowledge although some topics need enhancement. We found that HCWs have low perception of effectiveness of Covid-19 vaccines and willingness to receive the vaccine. Perception of effectiveness of Covid-19 vaccines is positive predictor of willingness to receive the vaccine controlling for demographic and health-related factors, while knowledge was not. Demographic characteristics of HCWs found to cause minimal influence on perception of effectiveness and limited also to willingness to receive vaccine although contributed significantly to knowledge. The study has implication for policy makers and health authorities and for HCWs, as well. There is a need to improve knowledge and content of training materials used by health professionals at various healthcare settings related to vaccinations and its effectiveness. Creating positive perception of effectiveness of vaccine will influence positively the public perception and enhance the accelerate of the vaccination campaigns. This need to direct programs and send messages to HCWs assessing their real concerns about the vaccines and create a positive atmosphere for discussion. Information provided and disseminated should be valid and retrieved

from reliable resources. On the other hand, there is a need to have more studies targeting novice HCWs who graduated recently and lived the online education, close down, and curfew which may have created negative attitudes due information on social media that is most probably invalid and inaccurate. Public authorities and HCWs need to be enhanced to speak positively about the vaccines in public and social media, and control and appropriately respond to negative and faulty information.

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